represents mere ledges of coral rock on the Admiralty chart: the 100-fathom line around each of three such reef rocks near the Exploring Isles is less than a mile in diameter, and the rocks are mere points; hence these minute reefs, beginning on small volcanic cones in the stage of sector G, must have been extinguished in sector J, resurgent in sector K, a little enlarged by outward growth in sector L, and almost extinguished again in sector M.

The upheaval and the sub-recent subsidence mentioned in the foregoing paragraph were not uniform, as has thus far been implied. The recent subsidence is believed to have increased to the east or northeast; first, as Agassiz pointed out, because the floor of the great lagoon of the Exploring Isles increases in depth from 20 fathoms or less on its western side to 80 or 100 fathoms on its eastern side; second, because several 'drowned atolls' or submerged banks lie to the northeast; indeed the northeastern-most of the seven outlying atolls is mostly submerged; third, because Mango, 10 miles to the southwest, has elevated reefs moderately dissected at an altitude of 500 feet, and 30 miles to the west, Yathata and Vatu Vará are uplifted, undissected atolls at altitudes of 840 and 1030 feet. The intermediate island of Kanathea, nearer to the Exploring Isles barrier reef than Mango is, also seemed to me to bear small uplifted reefs at a height of about 600 feet, but I was too far from this island to make sure of it.

The upheaval that preceded the subrecent subsidence must also have been unequal and greater to the east than to the west, because while the Exploring Isles were thus uplifted long enough ago to have been afterwards well dissected, Yathata and Vatu Vará were at that time presumably sinking and growing, preparatory to being uplifted recently as above stated. These unequal changes of altitude cannot be explained by changes in the level of the ocean, which are everywhere alike; they can be explained only by unequal subsidence and upheaval of the islands concerned.

INTERFEROMETER METHODS BASED ON THE CLEAVAGE OF A DIFFRACTED RAY

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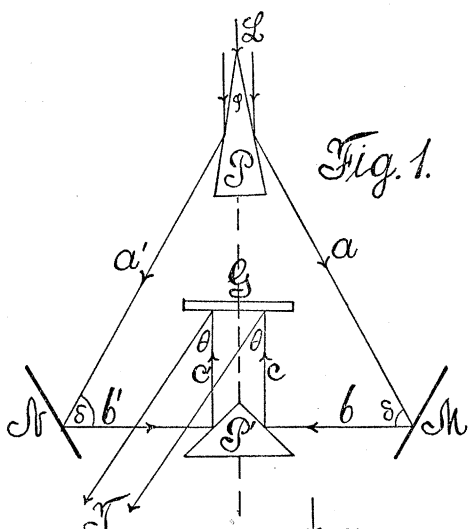
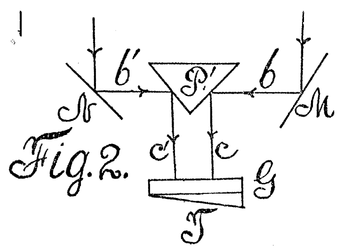
The prismatic method of cleaving the incident beam of white light is available for the superposition of non-reversed spectra, under conditions where the paths of the component rays may have any length whatever.

It is thus an essential extension of the same method as used for reversed spectra, heretofore, and also of the methods in which the paths are essentially small.

In figure 1, P is the first prism cleaving the white beam, L, diffracted by the slit of the collimator. M and N are the opaque mirrors, the former on a micrometer. For greater ease in adjustment, the second prism P' is here right angled, though this is otherwise inconvenient, since the angle, $\delta = 90°-\varphi$, is too large. The rays reflected from P' impinge normally on the reflecting grating G (grating space, $D = 200$





$\times 10^{-6}$) and are observed by a telescope at T. P, P', M and N are all provided with the usual three adjustment screws. P' must be capable of being raised and lowered and moved fore and aft. The field is brilliantly illuminated. When the path difference is sufficiently small the fringes appear and cover the whole length of superposed spectrum, strongly. They are displaced with rotation if M is moved normally to itself.

As first obtained the fringes were too close packed for accurate measurement; but the following example of the displacement, e, of the mirror

M, for successions of 40 fringes replacing each other at the sodium lines, show the order of results: $10^{-3}e = 1.55, 1.40, 1.60, 1.55$ cm., so that per fringe

$$\delta e = 39 \times 10^{-6} \text{ cm.}$$

The computed value would be (φ, the prism angle)

$\delta e = \lambda/2\cos(\delta/2) = 58.93\times10^{-6}/2\times0.81 = 36.4\times10^{-6}$ cm., assuming $\delta = 90°-\varphi$. The difference is due both to the small fringes which are difficult to count and to the assumed value of δ. The range of measurement is small (if M only moves), not exceeding 1.6 millimeters for a moderately strong telescope. Usually but one half of this displacement is available as the fringes increase in size (usually with rotation) from fine vertical hair lines to a nearly horizontal maximum and then abruptly vanish. But one half of the complete cycle is thus available.

If we regard the component beams, a, b, c, and a', b', c' as being of the width of the pencil diffracted by the slit of the collimator, it is clear that the maximum size of fringes will occur when c and c' are as near together as possible: furthermore, that as M moves toward P', c continually approaches c', until b drops off (as it were) from the right angled edge of the prism P'. To get the best conditions, i.e. the largest fringes, c must therefore also be moved up to the edge of P and very sharp angled prisms be used at both P and P'. The largest fringes (lines about 10 times the D_1D_2 distance) obtained with the right angled prism were often not very strong, though otherwise satisfactory. Much of the light of both spectra does not therefore interfere, being different in origin.

Results very similar to the present were described long ago[1] and found with two identical half gratings, coplanar and parallel as to rulings, etc., when one grating was displaced normal to its plane relative to the other. The edges of the two gratings must be close together, but even then the fringes remain small and the available paths also. Strong large fringes, but with small paths, were obtained by the later method[2] of two identical transmitting gratings, superposed.

If the prism P' is right angled, it may be rotated as in figure 2, so that the rays c and c' pass off towards the rear. They are then observed through an Ives' prism grating G and a telescope at T. This method admits of much easier adjustment. With the component beams, a, b, a', b', coplanar, horizontal and of about equal length in the absence of the prism P', the latter is now inserted with its edge vertical (rotation) and the white slit images in T (without G) superposed, horizontally and vertically. G is then added and the micrometer at M or N manipu-

lated till the fringes appears. As above, they are largest when c and c' are as nearly as possible coincident and vanish as horizontal fringes at the maximum; for the effective parts of c and c' are component halves of the same diffracted beam from the slit.

It is interesting to observe, since interference[3] also occurs when one of the superposed spectra is inverted on a line parallel to its length, that such diffraction is demonstrable in case of homogenous light, even when the slit is absent.

A fuller report of this work has been presented to the Carnegie Institution of Washington, D. C.

[1] *Phil. Mag.*, **22**, 118–129 (1911); *Carnegie Inst. Publ.*, No. 149, Chap. VI.
[2] *Physic. Rev.*, July, 1916; *Science*, **42**, 841 (1915).
[3] *Amer. J. Sci.*, **40**, §4, 491 (1915).

ON THE INHERITANCE OF CERTAIN GLUME CHARACTERS IN THE CROSS *AVENA FATUA* × *A. SATIVA* VAR. KHERSON

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The investigation reported in the present paper[1] deals with the inheritance of certain characters of the flowering glumes in a cross between a wild oat *Avena fatua* and a cultivated variety (*Avena sativa*). The cultivated oat used is a selection from the Kherson variety. Both parent strains have been grown as pure lines for five years and are known to breed true.

The parent varieties used in this cross possess the following contrasting glume characters.

CHARACTER	AVENA FATUA	AVENA SATIVA VAR. KHERSON
Grain color	Dark brown or black	Yellow
Base of grain	Wild type	Cultivated type
Shattering	Shatters	Does not shatter
Awns	Heavy, twisted and geniculate awns on both upper and lower grains of a spikelet	None or an occasional awn on the lower grain. None on the upper
Pubescence		
Base of grain	Thick pubescence on lateral and dorsal sides of callus on both grains	None or occasionally 1 or 2 hairs at the sides of the base of the lower grain
Back of grain	Heavy pubescence on the back of both grains	None
Pedicel	Heavy pubescence on both grains	None